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A SYSTEM FOR MONITORING EMPLOYEE HEALTH IN A NAVY OCCUPATIONAL --ETC(U)
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A SYSTEM FOR MONITORING EMPLOYEE HEALTH IN A NAVY OCCUPATIONAL SETTING

L. HERMANSEN & W. PUGH

REPORT NO. 81-3

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NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
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A System for Monitoring Employee Health in a Navy Occupational Setting

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Summary

Attempts to comply with provisions of the Occupational Safety and Health Act of 1970 and Executive Order 11807 have engendered a need for a comprehensive system that can monitor and document employee health and exposure patterns for extended periods of time. The present study tested the feasibility of using a one-page health treatment encounter form to monitor injuries and illnesses of workers in a Navy industrial setting. The encounter form, adapted from a medical treatment report developed for shipboard use, was tested at a Naval Regional Medical Center Branch Clinic during a twelve-day trial period. Information obtained for each patient visit included basic demographic data, visit status, symptoms or complaints, treatments provided, diagnoses and disposition. The encounter form was evaluated for ease of completion, intrusiveness upon patients and medical personnel, and clarity and comprehensiveness of acquired information. Data from the completed forms were processed electronically to obtain estimates of the patient load and patient composition at the clinic and to demonstrate potential uses of a health reporting system of this type.

These data indicated that 1,241 patients were treated during the twelve days of data collection for a projected annual caseload of 37,747 patients. The patient population was approximately half civilian and half military personnel. The majority of the occupational illnesses and injuries were incurred by civilian personnel, while the majority of the military personnel were treated for typical primary care symptoms and illness. These findings clearly indicated the need to provide a dual capability for reporting both primary care and occupational health information if the system is to be implemented at a branch clinic level. Additional analyses were conducted to: (a) compare the relative frequencies of illness episodes for military versus civilian workers, (b) indicate differences in the type of injury for specific occupations, (c) reveal differences in illness rates for various job types and, (d) suggest daily temporal trends of illnesses and injuries.

The trial implementation demonstrated that the system as tested provided an effective means of obtaining, storing, and retrieving individual and group health data. The proposed reporting system generally performed well at the branch clinic level, but certain modifications appeared useful for future applications. These modifications included the further simplification of the encounter form and the addition of an interactive computer-based component to the system. Simplification was required to reduce the number of inquiries left unanswered and to increase provider cooperation. The incorporation of an automated medical record keeping component would allow medical treatment data to be merged with personnel and environmental information thus meeting management requirements for the storage and retrieval of records and epidemiological requirements for sufficient data to investigate illness trends and identify correlates of illness.

A System for Monitoring Employee Health in a Navy Occupational Setting

Abstract

In response to a variety of requirements to document and monitor employee health in occupational settings, a medical treatment reporting system was developed and tested for 12 days at a Navy dispensary. A fundamental component of this system was an encounter form which documented the patient's background, visit status, symptoms, treatment, disposition, and diagnoses. These data were stored in an electronically accessible format and a series of previously programmed analyses were conducted to demonstrate potential uses of the data. As presently configured, the system would be beneficial in helping dispensaries meet present reporting requirements, but overall efficiency could be improved by use of an interactive terminal for data input.

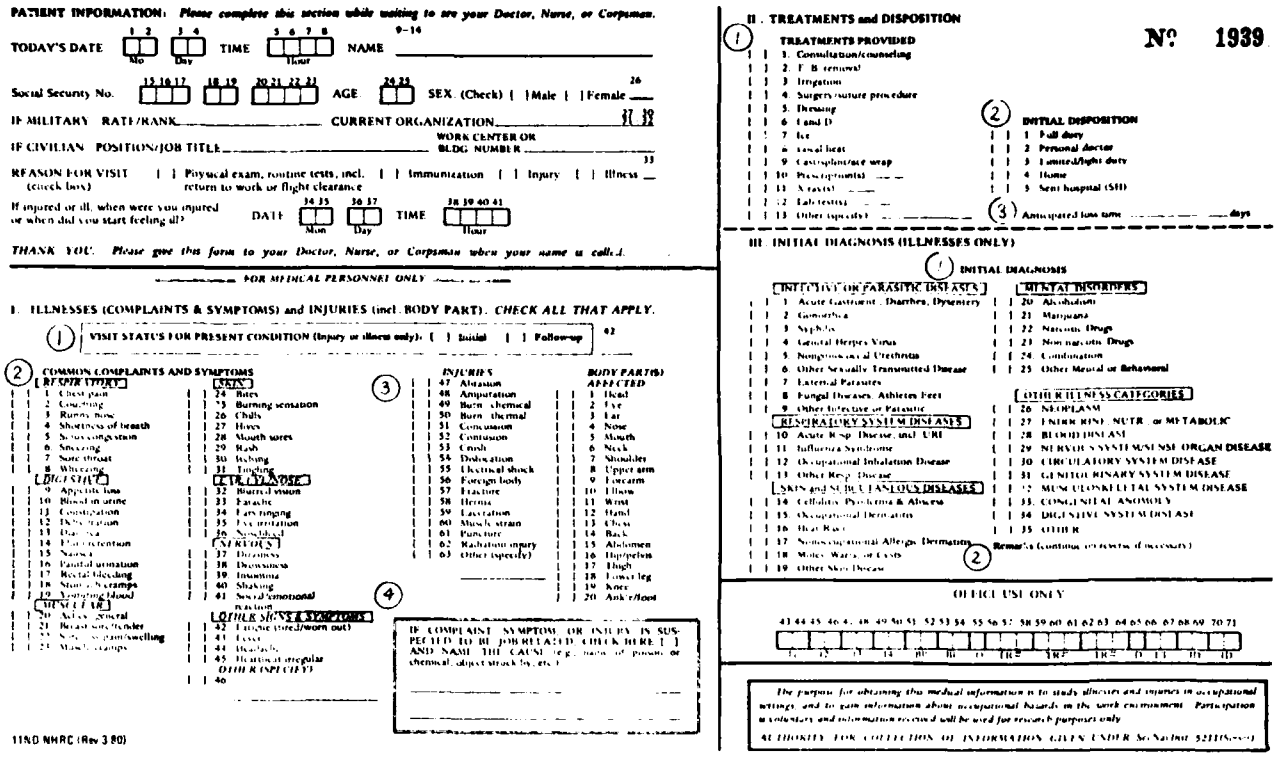
Recently there has been increased public concern over the potentially adverse influences that conditions in the work environment may exert upon individual health and safety. Consistent with this concern, the Occupational Safety and Health Act of 1970 (Public Law 91-596) was enacted to require employers to ensure safe working conditions for their employees. Executive Order 11807 extended the provisions of this act to the Federal Government. Subsequently, "... comprehensive, aggressive, and effective occupational safety and health programs ..." were directed (SECNAVINST 5100.10D) and established (OPNAVINST 5100.22A and 5100.23) within the Department of the Navy. Among other tasks, these instructions required "... periodic surveillance to confirm or detect early presymptomatic exposures to health hazards, materials, and environments in the worksite." Compliance with such instructions and with other provisions of the Occupational Safety and Health Act have engendered the need to develop comprehensive record systems that can monitor and document employee health and exposure patterns for extended periods of time.

The present report describes the trial implementation of a medical treatment reporting system developed for shipboard use (1) and adapted for Navy industrial environments. The medical treatment reporting system consisted of an encounter form for collecting outpatient medical information and an electronic processing unit for storing data and generating summary statistics. This system was used for a two-week trial period at a Naval Air Station dispensary to assess it's capability and feasibility for acquiring information about the types and frequencies of occupational illnesses and injuries experienced by military and civilian personnel in such an environment. Information gained from this study will be used to develop a more comprehensive Occupational Health Information System that will encompass additional information such as data on toxic substances, individual and group exposures, employee history, and physical examination results.

The Reporting System

The encounter form. The health care reporting form shown in Figure 1 was designed to gather health treatment information quickly and accurately without burdening the health care provider with additional paperwork. In addition to patient demographic data, the form requests information about visit status (initial or follow-up), the nature of complaint, symptoms, injuries, body parts affected, treatments, disposition, diagnosis, and whether or not the complaint, symptom, or injury is suspected to be job-related. This information is presented in a checklist format which allows the provider to supply medical treatment information by simply checking appropriate items on the form. (See Figure 1)

Figure 1. Medical Treatment Reporting Form



PATIENT INFORMATION: *Please complete this section while waiting to see your Doctor, Nurse, or Corpsman.*

TODAY'S DATE (1 2 Mo / 3 4 Day) TIME (5 6 7 8 Hour) NAME (9-14)

Social Security No. (15 16 17 / 18 19 / 20 21 22 23) AGE (24 25) SEX (Check) | | Male | | Female (26)

IF MILITARY RATE/RANK _____ CURRENT ORGANIZATION _____ (27-32)

IF CIVILIAN POSITION/JOB TITLE _____ WORK CENTER OR BLDG NUMBER _____ (33)

REASON FOR VISIT (check box) | | Physical exam, routine tests, incl. return to work or flight clearance | | Immunization | | Injury | | Illness

If injured or ill, when were you injured or when did you start feeling ill? DATE (34 35 Mon / 36 37 Day) TIME (38 39 40 41 Hour)

THANK YOU. Please give this form to your Doctor, Nurse, or Corpsman when your name is called.

FOR MEDICAL PERSONNEL ONLY

I. ILLNESSES (COMPLAINTS & SYMPTOMS) and INJURIES (incl. BODY PART). *CHECK ALL THAT APPLY.*

(1) VISIT STATUS FOR PRESENT CONDITION (Injury or illness only): | | Initial | | Follow-up (42)

(2) COMMON COMPLAINTS AND SYMPTOMS

RESPIR. SYSTEM: 1 Chest pain; 2 Coughing; 3 Runny nose; 4 Shortness of breath; 5 Sore/scratchy throat; 6 Sneezing; 7 Sore throat; 8 Wheezing

DIG. SYSTEM: 9 Appetite loss; 10 Blood in urine; 11 Constipation; 12 Defecation; 13 Diarrhea; 14 Fecal incontinence; 15 Nausea; 16 Painful urination; 17 Rectal bleeding; 18 Stomach cramps; 19 Vomiting blood

MUSCULAR: 20 Aches, general; 21 Broken bone/dislocation; 22 Sore, swollen/swelling; 23 Muscle cramps

SKIN: 24 Bites; 25 Burning sensation; 26 Chills; 27 Hives; 28 Mouth sores; 29 Rash; 30 Itching; 31 Tingling

EYE, EAR, NOSE: 32 Blurred vision; 33 Earache; 34 Ears ringing; 35 Eye irritation; 36 Nosebleed

NERVOUS: 37 Dizziness; 38 Drowsiness; 39 Insomnia; 40 Shaking; 41 Social/emotional problem

OTHER SIGNS & SYMPTOMS: 42 Fatigue (tired/worn out); 43 Fever; 44 Headache; 45 Heartbeat irregular; OTHER (SPECIFY): 46

(3) INJURIES: 47 Abrasion; 48 Amputation; 49 Burn: chemical; 50 Burn: thermal; 51 Concussion; 52 Contusion; 53 Cyst; 54 Dislocation; 55 Electrical shock; 56 Foreign body; 57 Fracture; 58 Hernia; 59 Laceration; 60 Muscle strain; 61 Puncture; 62 Radiation injury; 63 Other (specify)

BODY PART(S) AFFECTED: 1 Head; 2 Eye; 3 Ear; 4 Nose; 5 Mouth; 6 Neck; 7 Shoulder; 8 Upper arm; 9 Forearm; 10 Elbow; 11 Wrist; 12 Hand; 13 Chest; 14 Back; 15 Abdomen; 16 Hip/pelvis; 17 Thigh; 18 Lower leg; 19 Knee; 20 Ankle/foot

(4) IF COMPLAINT, SYMPTOM, OR INJURY IS SUSPECTED TO BE JOB RELATED, CHECK HERE | | AND NAME THE CAUSE (e.g., name of poison or chemical, object struck by, etc.)

1180 NHRC (Rev 3-80)

II. TREATMENTS and DISPOSITION

(1) TREATMENTS PROVIDED: 1 Consultation/counseling; 2 F.B. removal; 3 Irrigation; 4 Surgery/suture procedure; 5 Dressing; 6 I and D; 7 Ice; 8 Local heat; 9 Cast/splint/ace wrap; 10 Prescription(s); 11 X-ray(s); 12 Lab test(s); 13 Other (specify)

(2) INITIAL DISPOSITION: 1 Full duty; 2 Personal doctor; 3 Limited/light duty; 4 Home; 5 Sent hospital (SH)

(3) Anticipated loss time _____ days

No. 1939

III. INITIAL DIAGNOSIS (ILLNESSES ONLY)

(1) INITIAL DIAGNOSIS

INFECTIOUS OR PARASITIC DISEASES: 1 Acute Gastrointest. Diarrhea, Dysentery; 2 Gonorrhea; 3 Syphilis; 4 Genital Herpes Virus; 5 Nongonococcal Urethritis; 6 Other Sexually Transmitted Disease; 7 External Parasites; 8 Fungal Diseases, Athletes Foot; 9 Other Infectious or Parasitic

RESPIRATORY SYSTEM DISEASES: 10 Acute Resp. Disease incl. URI; 11 Influenza Syndrome; 12 Occupational Inhalation Disease; 13 Other Resp. Disease

SKIN and SUBCUTANEOUS DISEASES: 14 Cellulitis, Pyoderma & Abscess; 15 Occupational Dermatitis; 16 Other Rash; 17 Noninfectional Allergic Dermatitis; 18 Moles, Warts, or Cysts; 19 Other Skin Disease

MENTAL DISORDERS: 20 Alcoholism; 21 Marijuana; 22 Narcotic Drugs; 23 Nonnarcotic Drugs; 24 Combination; 25 Other Mental or Behavioral

OTHER ILLNESS CATEGORIES: 26 NEOPLASM; 27 ENDOCRINE, NUTR., or METABOLIC; 28 BLOOD DISEASE; 29 NERVOUS SYSTEM/SENSE ORGAN DISEASE; 30 CIRCULATORY SYSTEM DISEASE; 31 GENITOURINARY SYSTEM DISEASE; 32 MUSCULOSKELETAL SYSTEM DISEASE; 33 CONGENITAL ANOMOLY; 34 DIGESTIVE SYSTEM DISEASE; 35 OTHER

Remarks (continue on reverse if necessary) (2)

OFFICE USE ONLY

43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71

The purpose for obtaining this medical information is to study illnesses and injuries in occupational settings and to gain information about occupational hazards in the work environment. Participation is voluntary and information received will be used for research purposes only.

AUTHORITY FOR COLLECTION OF INFORMATION GIVEN UNDER SECNAVINST 5211.5(xxx)

The nature of the information contained on the form was dictated by the variety of services performed in a shore-based dispensary. For example, allowances had to be made for entry of both occupational data for employees in the industrial setting as well as regular outpatient treatment data for military personnel assigned to ships and aviation squadrons on the base. Further, data requirements differed for military and civilian patients, thus requiring a somewhat more comprehensive form than would otherwise be required. Additionally, the encounter form was designed to reduce the paperwork burden of the provider by providing a simplified method of obtaining information required in a variety of summary reports. Among the routine reports which require treatment data for completion and which influenced the format of the medical encounter form used in the present study were: the Report of Heat Casualty (NAVMED 6500/1); the Accidental Injury/Death Report (OPNAV 5102/1); the Report of Occupational Health Services (NAVMED 6260/1); and the Medical Services and Outpatient Morbidity Report (NAVMED 6300/1). The categories contained in the latter report were used to define the minimum requirements for the encounter form, however, additional items were included to allow finer discriminations to be made. Thus, the encounter form was extended by including items specific to one of the other forms listed above and by replacing extremely broad items by more refined categories. Finally, the form was designed so that it could be presented on one side of a single page in order to avoid any hand manipulation and thus minimize its intrusiveness, reduce omissions, and expedite the processing of completed forms.

Electronic data processing. The medical treatment information supplied by the encounter form was entered into the system by a data entry clerk after data provided by medical personnel was transferred to the area marked "office use only". The computer readable cards that were generated were batch loaded into an IBM 370 and a series of edit functions (checks for missing or out of range data, logical consistency errors, etc.) were performed.

Unusual responses were individually checked against the raw forms which had been filed by a serialized index number. The edited data were stored for rapid retrieval on magnetic tape and disks and existing programs were used to compile summary statistics.

System Implementation

The dispensary participating in the study was located at a Naval Air Station consisting of 17 separate commands with a combined population of approximately 7,000 military and 7,000 civilian personnel. Medical treatment information was collected over a 12-day period (2 work-weeks and 1 weekend) from all personnel treated at the dispensary. Prior to data collection, briefings were held with physicians, nurses, and corpsmen at the dispensary to explain the purpose of the study and methods of data collection. These meetings provided an opportunity to resolve logistical problems and to answer any questions about the form or its use.

During the data collection period, all patients (both civilian and military) were presented a blank medical treatment reporting form upon their arrival at the dispensary check-in desk. Each patient was requested to fill in the patient information section while waiting for treatment. After treatment, the health are provider completed the form by checking applicable items. The forms were then returned to a central location within the dispensary. At the end of the two-week data collection period all forms were returned to the Naval Health Research Center (NHRC) for processing.

Demonstration Analyses

Given the brevity of the data collection period, few if any epidemiological interpretations should be drawn from the illness data. However, several analyses were conducted to obtain an indication of the patient load and to evaluate the effort required to process the forms and to demonstrate potential uses of such data.

Initial frequency counts computed on the data gathered reveal that 1,241 people responded to an encounter form at the dispensary. Although most of the requested data were readily obtained, a few items had relatively high amounts of missing information. In the section completed by the patient, the items most frequently omitted were: "date and time when patient was injured or started feeling ill" (38% blank), "current organization" (18% blank), "work center or bldg. number" (9% blank), and "position/job title" (7% blank). In the section completed by medical personnel, the items omitted most frequently were "visit status for present condition" (41% blank), "treatments provided" (31% blank), and "initial disposition" (31% blank).

The majority of military personnel seeking outpatient treatment were from helicopter and fixed-wing squadrons stationed at the base. The majority of the civilians seen were employed at a Naval Air Rework Facility. A small number of personnel assigned to ships temporarily docked at the station ($\underline{n} = 4$) and an even smaller number of retired military personnel ($\underline{n} = 2$) were also treated during this period.

Visits to the dispensary were usually for one of three reasons: 1) illness, 2) injury, or 3) required physical examination (complete or partial). While the total number of visits for both groups was approximately equal (civilian = 551, military = 690), most military visits were for illness with the majority of civilian visits being injury related (see Figure 2). Further, it can be seen from Figure 3 that the military had proportionally fewer visits for occupational illnesses and injuries than the civilian population. This difference was expected since civilian workers were more likely to be engaged in the actual industrial activities while the majority of military personnel were tasked primarily with minor maintenance jobs required to keep the aircraft flight ready. (See Figures 2 and 3)

A set of analyses designed to explore the different types of occupational injuries that were experienced by both military and civilian personnel were conducted and the results are shown in Table 1. These data show that muscle strains and lacerations were the most common types of injury incurred during the study. Further analysis

Figure 2. Comparison of Civilian and Military Reasons for Visits to Dispensary

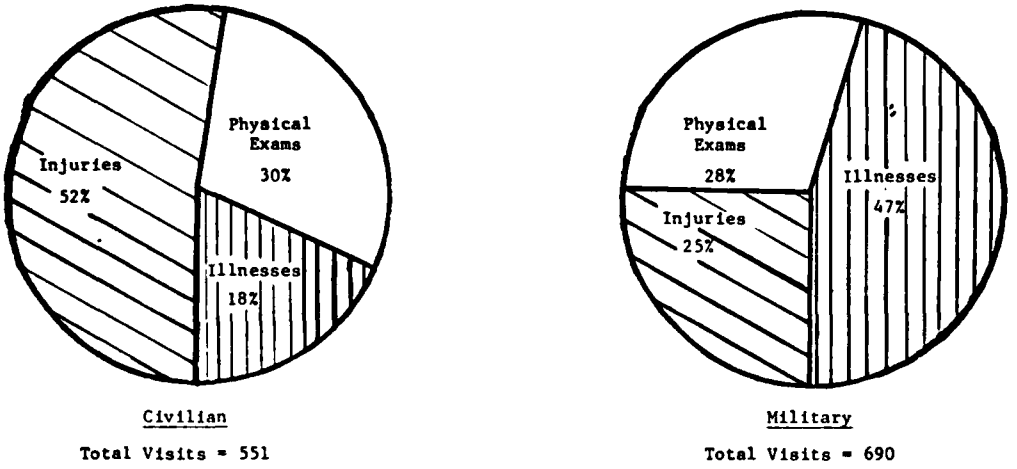


Figure 3. Comparison of Civilian and Military Reported Occupational Injuries and Illnesses

revealed that the muscle strains usually involved the back whereas the lacerations were most commonly located on the hand.

Table 1

Frequency of Occupational Injuries by Type

Military		Civilian	
Type	Number	Type	Number
Muscle strain	4	Laceration	51
Laceration	3	Muscle strain	30
Foreign body	1	Contusion	26
Burn-chemical	1	Foreign body	19
Rash	1	Puncture	15
Muscle cramps	1	Abrasion	15
Muscle pain	1	Crush	7
Coughing	1	Rash	6
Total	13	Burn-heat	5
		Fracture	3
		Concussion	3
		Burn-chemical	2
		Coughing	1
		Hives	1
		Itching	1
		Eye irritation	1
		Unspecified	15
		Total	201

Another set of analyses were performed to determine the frequency of occupational injuries and illnesses for each job type (See Table 2). These analyses were limited to civilian visits because of the small number of visits by military personnel for job-related problems. Close examination of these data revealed that civilian workers were treated more frequently for job-related injuries. In fact, the only suspected occupational illnesses reported were minor skin disorders. Civilian sheet metal mechanics had the highest frequency of job-related visits (n = 48) followed by aircraft electricians (n = 20) and aircraft mechanics (n = 15).

The difficulty in diagnosing industrial illness combined with active industrial hygiene programs in effect at the base, probably contributed to the relatively small number of occupational illnesses reported above. As noted in an earlier report (2), the presence of industrial injuries is easily diagnosed by all parties because of their acute nature and the cause of the injury is usually self-evident. Illnesses caused by chemicals, noise, and radiation, however, usually occur only after extensive periods of exposure and thus the early stages often go unnoticed even by the victims.

By combining information such as reported above with data from other sources one can often obtain a more interpretable result. For example, data about the number of injuries is generally not as informative or useful as is information about the ratio of injury frequency in the populations at risk (injury rates). Additional knowledge was obtained about the total number of workers in each job-type in order to generate the statistics presented in Table 3. These rates were calculated only for occupations with more than fifty employees. As might

be expected, workers in the mechanical trades incurred the highest injury rates. It is also interesting that clerk/secretaries experienced a relatively high injury rate even though the severity of their types of injuries was minor. Were this trend to continue through time, it might provide useful information for industrial hygienists and safety personnel in their attempts to improve work conditions. Without such evidence as provided in this type of report, however, it is less likely that clerk/secretaries would be seen as needing particular attention.

TABLE 2

JOB RELATED INJURIES IN DESCENDING ORDER BY OCCUPATION (CIVILIAN)

SHEET METAL MECHANIC (48*)		A/C ELECTRICIAN (23)		A/C MECHANIC (15)		MACHINIST (14)	
FOREIGN BODY	(11)	LACERATION	(6)	LACERATION	(9)	LACERATION	(6)
LACERATION	(9)	MUSCLE STRAIN	(4)	MUSCLE STRAIN	(2)	MUSCLE STRAIN	(2)
MUSCLE STRAIN	(8)	PUNCTURE	(4)	RASH	(1)	RASH	(2)
CONTUSION	(8)	ABRASION	(1)	CONTUSION	(1)	ITCHING	(1)
PUNCTURE	(5)	BURN-HEAT	(1)	FOREIGN BODY	(1)	ABRASION	(1)
ABRASION	(2)	CONTUSION	(1)	PUNCTURE	(1)	FRACTURE	(1)
RASH	(1)	FOREIGN BODY	(1)			UNSPECIFIED	(1)
CHEM. BURN	(1)	UNSPECIFIED	(2)				
CRUSH	(1)						
UNSPECIFIED	(2)						

ELECTRONICS MECHANIC (10)		A/C ENGINE MECHANIC (9)		ROTOR BLADE MECHANIC (7)		CLERK/SECRETARY (7)	
LACERATION	(3)	CONTUSION	(5)	FOREIGN BODY	(2)	CONCUSSION	(2)
ABRASION	(2)	FRACTURE	(1)	LACERATION	(2)	BURN-HEAT	(2)
CONTUSION	(2)	LACERATION	(1)	PUNCTURE	(1)	ABRASION	(1)
MUSCLE STRAIN	(2)	MUSCLE STRAIN	(1)	HIVES	(1)	CONTUSION	(1)
UNSPECIFIED	(1)	PUNCTURE	(1)	UNSPECIFIED	(1)	MUSCLE STRAIN	(1)

ELECTRICIAN (4)		ELECTROPLATER (4)		LABORER (4)		WOODWORKER (4)		WAREHOUSEMAN (4)	
LACERATION	(2)	LACERATION	(2)	LACERATION	(2)	ABRASION	(1)	ABRASION	(3)
MUSCLE STRAIN	(1)	MUSCLE STRAIN	(1)	BURN-HEAT	(1)	CONTUSION	(1)	CONTUSION	(1)
UNSPECIFIED	(1)	BURN-CHEM.	(1)	EYE IRRITATION	(1)	FOREIGN BODY	(1)		
						MUSCLE STRAIN	(1)		

AUTO WORKER (3)		PRODUCTION CONTROL (3)		SHOP LEARNER (3)		SANDBLASTER (3)		PIPEFITTER (3)	
LACERATION	(1)	MUSCLE STRAIN	(3)	RASH	(2)	CRUSH	(1)	CONTUSION	(3)
UNSPECIFIED	(2)			CRUSH	(1)	FRACTURE	(1)		
						PUNCTURE	(1)		

PAINTER (3)		DROP HAMMER OPERATOR (3)		RUBBER WORKER (3)		WELDER (2)		METALSMITH (2)	
CONTUSION	(1)	CRUSH	(3)	LACERATION	(3)	FOREIGN BODY	(1)	PUNCTURE	(2)
MUSCLE STRAIN	(1)					UNSPECIFIED	(1)		
UNSPECIFIED	(1)								

Q. A. SPECIALIST (1)		WORKER TRAINEE (1)		SECURITY POLICE (1)		FIREFIGHTER (1)		WOOD CRAFTSMAN (1)	
ABRASION	(1)	LACERATION	(1)	CONTUSION	(1)	CRUSH	(1)	FOREIGN BODY	(1)

RIGGER (1)		POWER SUPPORT SYSTEMS MECHANIC (1)		PLASTICS AND FIBERGLASS WORKER (1)	
MUSCLE STRAIN	(1)	ABRASION	(1)	CONCUSSION	(1)

MOTOR VEHICLE OPERATOR (1)		METALIZING EQUIPMENT OPERATOR (1)		A/C EXAMINER (1)	
MUSCLE STRAIN	(1)	FOREIGN BODY	(1)	ABRASION	(1)

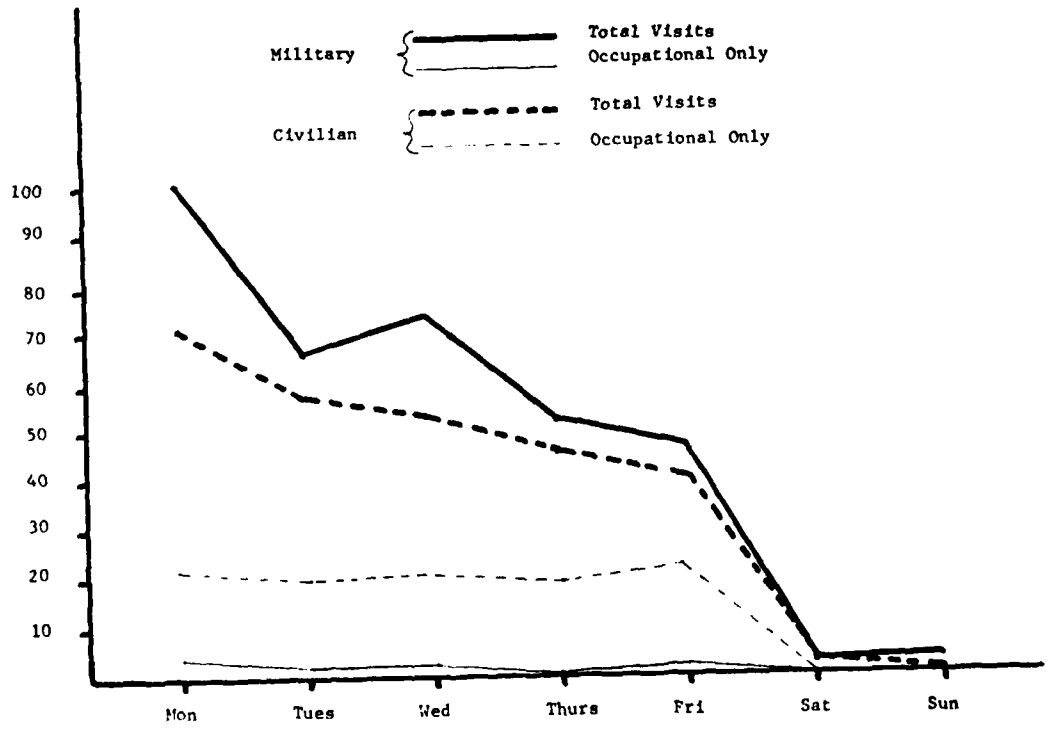
*NUMBER OF CASES

Table 3

Rank Ordering of Job-types by Occupational Injury Rate

Job-Type	N	Number of Injuries	Injury Rate
Rotor blade mechanic	69	7	.10
Sheet metal mechanic	716	48	.07
Clerk/secretary	102	7	.07
Electronics mechanic	221	10	.05
A/C engine mechanic	200	9	.05
Auto mechanic	55	3	.05
Shop learner	58	3	.05
Machinist	321	14	.04
Electroplater	96	4	.04
A/C electrician	588	20	.03
A/C mechanic	610	15	.02
Painter	161	3	.02
Security/police	53	1	.02
Production control	273	3	.01
Firefighter	101	1	.01
A/C examiner	81	1	.01

Figure 4. Mean Number of Dispensary Visits by Day of Week



The final set of analyses reveals daily temporal trends. Average numbers of visits were computed and plotted for each day of the week for military and civilian populations separately (see Figure 4). The total number of visits for both groups was elevated at the beginning of the week and declined as the week progressed Visits for job-related incidents, however, remained relatively constant throughout the week. Very few visits occurred during the weekend for either occupational or nonoccupational problems.

In viewing the foregoing results, however, the reader should bear at least two points clearly in mind. First, there tends to be high variability in illness and accident rates over the short term. Thus, the trends reported above may not truly represent the picture that would emerge if data from a longer period were analyzed. Second, the analyses were conducted to demonstrate potential uses and are by no means exhaustive. There are likely to be many other applications of greater utility to particular users if such comprehensive outpatient data were routinely available.

Evaluation of the Reporting System

The encounter form and reporting system discussed in this paper represent a first step in the development of a comprehensive occupational health system. Generally, the system performed well though problems with obtaining certain types of data were found. It appeared that items omitted in the section completed by medical personnel were simply overlooked by the health care provider. Thus, one possible method for reducing the rate of missing data for these items would be to change the format so it clearly led from one item to the next. Omissions in the section completed by the patient, however, appeared to reflect uncertainty about exactly what was being requested. This latter problem might be alleviated by making the labels clearer and by having someone scan each form for completeness while the patient is waiting to be treated by the medical provider. However, omissions of demographic data may not be a problem if such information can be retrieved from other sources. For instance, it may be possible to obtain military rate and rank or civilian occupation from automated personnel files and thus eliminate the need to have the patient supply that data.

Perhaps the most effective method to resolve such problems is the use of an interactive computer terminal for data input. An interactive system presents one question at a time. Thus, items are not overlooked. Such a system, however, requires real time processing of the data and thus the installation of time-sharing or dedicated mini- or micro-computers at the site.

In spite of potential drawbacks in the batch process approach used in this study, however, the system as tested would be of substantial benefit to the dispensary because it satisfies reporting requirements and simultaneously provides valuable epidemiological information. Such a system has certain costs, however. The test required the efforts of two full-time personnel; one to perform initial coding of the data, a second to complete coding, data edit and keypunching. Once the data were batch loaded into the computer, existing programs were used and therefore the effort required was minimal. To implement such a system on a long-term basis, however, would require specialized computer routines to generate specific reports and to access a data base of constantly increasing scope. Although routines are commercially available to perform this type of function, it is likely that such a system will also require the efforts of a skilled programming staff to attain full utilization of the data.

The system as tested, therefore, was somewhat expensive in terms of manpower and in the amount of time that passes between the actual visit and the point when the data are stored in a computer retrievable form. Thus, an interactive system appears attractive. In such a system, the data entry clerk performs all coding and data entry functions. Further, all data edits are performed at the time that the information is entered. Thus, an interactive system appears attractive. In such a system, the data entry clerk performs all coding and

data entry functions. Further, all data edits are performed at the time that the information is entered. Thus, an interactive system appears attractive. In such a system, the data entry clerk performs all coding and data entry functions. Further, all data edits are performed at the time that the information is entered. Thus, it is expected that such a system would require only half of the manpower required to operate an equivalent system based on batch process techniques. More important, however, is the versatility gained by use of an interactive system. The use of branching logic and other files stored within the system not only reduces the number of potentially inappropriate items presented at each encounter but focuses in on the information that is of greatest importance for the particular visit. For example, data regarding work site, rank, etc. could be obtained from other files, while questions regarding the nature of an injury would be presented only if it had been indicated that an injury had occurred. Thus, time demands on both patient and provider are reduced at no cost in the information obtained.

An automated interactive system appears even more attractive when one considers the increasing demands being placed upon Navy facilities to record and store for extended periods of time information regarding workers' health, the training each worker receives, and the environmental hazards to which individual workers were exposed. Moreover, because of vast increases in the time and effort needed to meet such requirements, it is likely that an automated system will provide the only effective method for managing such a burden, given the high degree of redundancy in the information among the required reports. For example, much of the data required to generate the Navy Monthly Morbidity Report (6300/1), the report of Occupational Health Services (NAVMED 6260/1), or the Report of Heat Casualty (NAVMED 6500/1) are also required by the Department of Labor (e.g., the CA1 or CA2 form). Similarly, data stored to meet OSHA record keeping requirements are needed to satisfy the above reporting tasks. At the present, these overlapping requirements are often addressed separately. Once data are electronically stored, however, the information may be applied to several different uses thus reducing the duplication of effort and increasing efficiency.

Although any record keeping system might be made more manageable by using a single multipurpose reporting form, such a step represents only a partial solution because a variety of data are required to meet different needs. Therefore each report requires some information not needed in other reports. An automated networking system would be a more satisfactory solution because (1) much of the required information could be acquired automatically from other sources and (2) only that information needed to fulfill reporting or other requirements would be processed in the system. In addition, the capability exists to acquire and integrate occupational health data in more detail than is being done presently. For example, the linking of number of illnesses (health data) to number of individuals in an occupation (personnel data) could be used to derive illness rates which in turn may be compared to a third file containing a list of hazards associated with particular occupations. In this way epidemiological analyses may identify a significant relationship between an environmental condition and worker health possibly leading to recommendations for remedial action.

Summary

In view of the potential advantages of an automated system the present study focused upon the development of viable methods for obtaining, storing, and retrieving medical treatment data. These data when stored in a readily retrievable form provide a reliable data base that can be used to automatically generate required reports and provide necessary information for epidemiological studies related to occupational illnesses and injuries. Finally, the data base provides an efficient means of storing records required to show compliance with occupational safety and health regulations.

The encounter form described in the present paper is an integral part of a comprehensive occupational

health information system. By storing data in an electronically readable form, benefits are gained in terms of meeting management requirements and epidemiological needs. Management requirements necessitate the development of a data base which can be used to index individual health records for quick access and which can provide information for the completion of summary reports. Epidemiological needs are met when such a data base of illness information is supplemented with personnel and environmental data in a comprehensive medical information system.

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In response to a variety of requirements to document and monitor employee health in occupational settings, a medical treatment reporting system was developed and tested for 12 days at a Navy dispensary. A fundamental component of this system was an encounter form which documented the patient's background, visit status, symptoms, treatment, disposition, and diagnoses. These data were stored in an electronically accessible format and a series of previously programmed analyses were conducted to demonstrate potential uses of

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the data. As presently configured, the system would be beneficial in helping dispensaries meet present reporting requirements, but overall efficiency could be improved by use of an interactive terminal for data input.